

## CLAIMS

### WHAT IS CLAIMED IS:

1. A rotary expander which produces power by the expansion of supplied high-pressure fluid, the rotary expander comprising:

a plurality of rotary mechanism parts (70, 80), each of which includes: a cylinder (71, 81) whose both ends are blocked; a piston (75, 85) for forming a fluid chamber (72, 82) in the cylinder (71, 81); and a blade (76, 86) for dividing the fluid chamber (72, 82) into a high-pressure chamber (73, 83) on the high-pressure side and a low-pressure chamber (74, 84) on the low-pressure side; and

a rotating shaft (40) which engages with the piston (75, 85) of each of the plural rotary mechanism parts (70, 80);

wherein:

the plural rotary mechanism parts (70, 80) have different displacement volumes from each other, and are connected in series in ascending order of the different displacement volumes;

in regard to two mutually connected rotary mechanism parts among the plural rotary mechanism parts (70, 80) one of which is a front-stage side rotary mechanism part (70) and the other of which is a rear-stage side rotary mechanism part (80), the low-pressure chamber (74) of the front-stage side rotary mechanism (70) and the high-pressure chamber (83) of the rear-stage side rotary mechanism part (80) come into fluid communication with each other, resulting in the formation of a single expansion chamber (66); and

the rotary expander includes: an injection passageway (37) through which a part of the high-pressure fluid is introduced into the expansion chamber (66) in the process of expansion; and a distribution control mechanism provided in the injection passageway (37).

2. The rotary expander of claim 1, wherein:

the cylinders (71, 81) of the plural rotary mechanism parts (70, 80) are stacked one

upon the other in a layered manner with an intermediate plate (63) interposed therebetween;

each said intermediate plate (63) is provided with a communicating passageway (64) wherein, in regard to two adjacent rotary mechanism parts among the plural rotary mechanism parts (70, 80) one of which is a front-stage side rotary mechanism part (70) and the other of which is a rear-stage side rotary mechanism part (80), the low-pressure chamber (74) of the front-stage side rotary mechanism (70) and the high-pressure chamber (83) of the rear-stage side rotary mechanism part (80) are brought into fluid communication with each other by the communicating passageway (64); and

the injection passageway (37) is formed in the intermediate plate (63) so as to open, at a terminal end thereof, to the communicating passageway (64).

3. The rotary expander of claim 1, wherein the injection passageway (37) opens, at a terminal end thereof, to the high-pressure chamber (83) of at least one rotary mechanism part among the plural rotary mechanism parts (70, 80) that has a displacement volume greater than the smallest displacement volume.

4. The rotary expander of any one of claims 1-3, wherein the distribution control mechanism is formed by a regulating valve (90) the valve opening of which is regulatable.

5. The rotary expander of any one of claims 1-3, wherein the distribution control mechanism is formed by an openable/closable solenoid valve (91).

6. The rotary expander of any one of claims 1-3, wherein the distribution control mechanism is formed by a differential pressure regulating valve (92) the valve opening of which varies depending on the difference in pressure between fluid in the expansion chamber (66) and fluid which has flowed out of a rotary mechanism part (80) having the greatest displacement volume.

7. The rotary expander of any one of claims 1-3, wherein fluid which is introduced into the high-pressure chamber (73) of a rotary mechanism part (70) having the smallest displacement volume is carbon dioxide above critical pressure.

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